WHAT IS CLAIMED IS:

1. A rotating electrical machine for a vehicle, comprising:

a stator including a multi-phase armature winding wound around an armature core;

a rotor including a pair of field cores which are disposed at an inner diameter side of the armature core through a gap and rotate together with a rotating shaft; and

a field winding for magnetizing the pair of field cores,

wherein the pair of field cores respectively includes a plurality of magnetic poles extending in an axial direction of the rotating shaft and being arranged to alternately engage with each other through a predetermined clearance Dc,

each of the plurality of magnetic poles having a width in a rotation direction thereof is formed in a stair shape to be smaller toward a tip of width, and

the clearance Dc between adjacent the plurality of magnetic poles is set within a range from 50° to 70° in electrical angle.

2. A rotating electrical machine for a vehicle according to claim 1, wherein the width of each of the stair-shaped magnetic poles in the rotation direction has a two-step structure in which the width at the tip is narrow, and when the magnetic pole width at a wide side is made Da in electrical

angle and the magnetic pole width at a narrow side is made Db in electrical angle, the magnetic pole width Da and the magnetic pole width Db are set within ranges of

$(206 - Dc)° \leq Da \leq (226 - Dc)°$ and

$(134 - Dc)° \leq Db \leq (154 - Dc)°$.

3. A rotating electrical machine for a vehicle according to claim 1, wherein the width of each of the stair-shaped magnetic poles in the rotation direction has a multi-step structure in which the width at the tip is narrow, and when respective widths of the magnetic pole are divided into a Da group and a Db group in electrical angle, the Da group and the Db group of the respective magnetic pole widths are set within ranges of

$(206 - Dc)° \leq Da \leq (226 - Dc)°$ and

$(134 - Dc)° \leq Db \leq (154 - Dc)°$.

4. A rotating electrical machine for a vehicle according to claim 1, wherein corners of step parts and corners of tip parts of the stair-shaped magnetic poles are cut off to form chamfer shapes.

5. A rotating electrical machine for a vehicle according to claim 1, further comprising inclined parts, whose magnetic pole widths are changed in the axial direction of the rotating shaft, between respective parts of the stair-shaped magnetic poles where the magnetic pole widths are different from each other.

6. A rotating electrical machine for a vehicle according to claim 1, wherein ring-shaped coupling members are fitted to at least tip part outer peripheries of the magnetic poles.

7. A rotating electrical machine for a vehicle according to claim 6, wherein a magnetized permanent magnet intervenes between adjacent magnetic poles, and the coupling members are saturated by a magnetic flux of the permanent magnet.

8. A rotating electrical machine for a vehicle according to claim 1, wherein the armature core includes slots around which the armature winding is wound, the number of slots is two for each polarity and each phase, and open pitches between the respective slots are uneven pitches.

9. A rotating electrical machine for a vehicle according to claim 8, wherein the open pitch between the slots in which adjacent windings having a same phase are inserted is 32.5° in electrical angle, and the open pitch between the slots in which adjacent windings having different phases are inserted is 27.5° in electrical angle.

10. A rotating electrical machine for a vehicle according to claim 8, wherein the width of each of the stair-shaped magnetic poles in the rotation direction has a two-step structure in which the width at the tip is narrow, and when the magnetic pole width at a wide side is made Da in electrical angle and the magnetic pole width at a narrow side is made Db in electrical angle, the magnetic pole width

Da and the magnetic pole width Db are set within ranges of

$(195.7 - Dc)° \leq Da \leq (215.7 - Dc)°$ and

$(144.3 - Dc)° \leq Db \leq (164.3 - Dc)°$.

11. A rotating electrical machine for a vehicle according to claim 8, wherein the width of each of the stair-shaped magnetic poles in the rotation direction has a multi-step structure in which the width at the tip is narrow, and when respective widths of the magnetic pole are divided into a Da group and a Db group in electrical angle, the Da group and the Db group of the respective magnetic pole widths are set within ranges of

$(195.7 - Dc)° \leq Da \leq (215.7 - Dc)°$ and

$(144.3 - Dc)° \leq Db \leq (164.3 - Dc)°$.

12. A rotating electrical machine for a vehicle according to claim 1, wherein a step part whose tip side is expanded is provided at an inner diameter side of the stair-shaped magnetic pole and at an almost identical position to a step part of the stair shape.

13. A rotating electrical machine for a vehicle according to claim 12, wherein corner parts of the magnetic poles at the tip part inner diameter side are cut out to form chamfer shapes.

14. A rotating electrical machine for a vehicle according to claim 12, wherein a permanent magnet is fitted to the extreme tip side inner surface of the step part provided

at the inner diameter of the magnetic pole.